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The Effect of Bandwidth on Space-Time Adaptive Processing (STAP)

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Abstract In the airborne radar environment, STAP is used to suppress ground clutter returns. Most of the analysis on space-time adaptive processing to date has used the narrowband signal model. In this paper new results on the effect of bandwidth on STAP are presented. Bandwidth leads to dispersion in two dimensions, both across the array in the angle domain and across the coherent processing interval in the Doppler domain. When the array is not aligned with the platform's velocity vector the dispersion leads to a broadening of the clutter ridge and a degradation in the radar's minimum detectable velocity performance. However, in the absence of misalignment between the array and the platform's velocity vector the effects of bandwidth are negligible. For reasons of computational complexity and sample support, reduced dimension algorithms are required for the practical implementation of STAP. Previous analysis using the narrowband signal model shows that postDoppler STAP algorithms perform better than their pre-Doppler counterparts. However, we show that the coherent gain on clutter due to the Doppler filtering applied to the data prior to adaptive processing makes post-Doppler STAP algorithms more susceptible to the effects of bandwidth. Time delay steering (TDS) has been proposed as a method of mitigating the effects of dispersion. While conventional (spatial) TDS improves angular coverage in the presence of jamming, it does not compensate for the Doppler component of dispersion when suppressing clutter. In STAP minimizing both the spatial and Doppler dispersion on the mainlobe clutter with TDS in both domains provides the most improvement.